1 year of age, six in the age group 1 year to 2 years, and nine each in the groups of 15 to 20 and 20 to 30 years. The disease occurred generally along the lines of railway traffic. The total estimated population of Wellington Health District, which includes the Provinces of Wellington, Taranaki, Hawkes Bay, Marlborough, and Nelson, and Cook County, is 379,102.

BIOLOGICAL PRODUCTS.

NOTICE TO THOSE CONCERNED.

In view of the fact that some establishments licensed for the manufacture and sale of biological products located in Germany have not been inspected within the time required by regulation and on account of present conditions will be inaccessible to inspection for an indefinite period of time, the department has revoked the licenses of these establishments, and notification of this fact is hereby given to all concerned.

The establishments in question with their license numbers and products are the following:

No. of license.	Name.	Products.
12	Chemische Fabrik auf Actien, Berlin, Germany.	Antigonococcus vaccine, antistreptococcic serum, diphtheria antitoxin, and tuberculin.
24	Farbwerke, vormals Meister Lucius und Brüning, Hoechst on Main, Germany.	Antidysenteric serum, antimeningococcic serum, antipneumonic serum, antistreptococcic serum, antitetanic serum, diphtheria antitoxin, tuberculins.
29	The Behringwerk, Marburg, Germany.	Antitetanic serum and tuberculin.
31	E. Merck, Darmstadt, Germany.....	Antimeningococcic serum, antipneumonic serum, antitreptococcic serum, diphtheria antitoxin, jecuritol serum, leucofermantin (antitryptic sheep serum), normal horse serum (liquid and dried), tuberculins, and bacterial vaccines prepared from colon bacillus, dysentery bacillus, gonococcus, pneumococcus, staphylococci, streptococci, and typhoid bacillus.
32	Kalle & Co., Biebrich, Germany.....	Tuberculin (Rosenbach).
39	Pharmaceutisches Institut Ludwig Wilhelm Ganz, Oberursel bei Frankfort a. M., Germany.	Antidysenteric serum.
55	Chemische Fabrik Güstrow, Güstrow i. M., Germany.	Staphylococcus vaccine.

DETECTION OF HYDROCYANIC ACID GAS.

USE OF SMALL ANIMALS FOR THIS PURPOSE.

By S. B. GRUBBS, Surgeon, United States Public Health Service.

Instructions issued on November 4, 1916, to officers of the Public Health Service on the subject of hydrocyanic acid gas fumigation of vessels directed that "Before declaring it safe to enter holds, a captive animal (guinea pig, rat, cat, etc.) shall be lowered and exposed to the aerial content of such compartments, and the effect produced, if any, shall be a guide in estimating the amount of gas present."

Just what dilution of hydrocyanic acid gas should be considered dangerous to man can not be definitely stated, but in fumigating the holds of vessels any gas that brings on vertigo may cause a fatal fall.[1] In trying to determine this point several volunteers have breathed gas from ½ and from ¾ ounce sodium cyanide per 1,000 cubic feet for two minutes and one and one-half minutes, respectively, without feeling any effect, but this has at other times caused dizziness. In these cases the men were breathing quietly and the effects would doubtless be considerably increased and the danger of falling would be greater if the same men were undergoing physical exertion such as climbing out of the hold of a vessel. The writer believes that where work must be done and a climb is required to reach the open air a mixture of 0.024 per cent hydrocyanic acid gas (one-half ounce sodium cyanide per 1,000 cubic feet) should be considered the limit of safety.

With this limitation in mind the susceptibility of small animals usually available for the purpose of testing holds has been studied. A good test animal may be said to be one that is readily obtained and easily handled and that promptly shows visible symptoms when breathing the gas in considerable dilution, but does not soon die after showing systoms.

The following experiments were made in a practically air-tight room of about 500 cubic feet. The gas was generated in a jar placed in the center of the room, and time in each case was reckoned from the minute the sodium cyanide was dropped into the acid. The animals were confined in small cages placed in front of a window in one corner of the room 4 feet above the floor. They were about 5 feet from the generator. Ninety-six to ninety-eight per cent sodium cyanide, 1 ounce of which in 1,000 cubic feet gives approximately 0.048 per cent of hydrocyanic acid gas, was used.

[1] Passed Asst. Surg. Friench Simpson has noted that employees exposed to the fumes of cyanide in their routine work seemingly acquire a considerable resistance to the effects of gas.

	1 ounce NaCN per 1,000 cubic feet; temperature 40° F.		¾ ounce NaCN per 1,000 cubic feet; temperature 40° F.		½ ounce NaCN per 1,000 cubic feet; temperature 17° F.		½ ounce NaCN per 1,000 cubic feet; temperature 40° F.		½ ounce NaCN per 1,000 cubic feet; temperature 80° F.		⅔ ounce NaCN per 1,000 cubic feet; temperature 35° F.		¼ ounce NaCN per 1,000 cubic feet; temperature 35° F.	
	First effect.	Final result.	First effect.	Final result.	First effect.	Final result.	First effect.	Final result.	First effect.	Final result.	First effect.	Final result.	First effect.	Final result.
	Minutes.		*Minutes.*		*Minutes.*		*Minutes.*		*Minutes.*		*Minutes.*		*Minutes.*	
Guinea pig	5	Dead; 20 minutes.	35	Removed alive; 1 hour; recovered.	20	Alive; 1 hour; died later.	None. None.	None. None.	None.	No effects; 1 hour.				
Adult wild rat							6 9	Dead; 42 minutes. Alive; 1 hour; died later.	12	Dead; 50 minutes.				
Half-grown wild rat							6 9	Alive; 1 hour; recovered. Dead; 25 minutes.	8	Dead; 50 minutes.				
Adult tame rat	2	Dead; 15 minutes.	4	Dead; 40 minutes.	5 13	Removed alive; 10 minutes. Removed alive; 15 minutes.	7 8	Alive; 1 hour; recovered. Alive; 1 hour; recovered.	8	Removed alive; 1 hour; recovered.	10	Removed; 25 minutes; recovered.	None.	Removed; 1 hour;
Half-grown tame rat							5 6	Alive; 1 hour; recovered. Dead; 33 minutes.	6	Removed alive; 1 hour; died later.				
Mouse					[1] 20 4	Dead; 25 minutes. Removed alive; 10 minutes.	5½ 11	Dead; 37 minutes. Dead; 55 minutes.	5	Dead; 40 minutes.	10	Removed; 25 minutes; recovered.	(2)	Dead; 30 minutes.
Cat			3	50 minutes.			9	Dead; 33 minutes.	5	Removed alive; 1 hour; recovered.				
Sparrow					[1] 45 6 1	Dead; 2½ minutes. Dead; 8 minutes. Dead; 3 minutes.					13	Dead; 20 minutes.	40	Dead; 40 minutes.
Pigeon					8	Dead; 9 minutes.								

[1] Seconds.

[2] Not noted.

From these experiments and from our regular work the following observations may be made:

Guinea pigs.—Although usually available and easily handled, guinea pigs are quite resistant to hydrocyanic acid gas and may easily show no symptoms after 5 or 10 minutes in percentages of gas that may be dangerous to man. They are, therefore, the least suited of animals tried, and if used to detect cyanide gas due allowance for their superior resisting powers should be made.

Sparrows.—These birds are very susceptible indicators, but die almost immediately after showing the first symptoms. It is believed that canary birds, which are used by the Bureau of Mines to indicate the presence of carbon monoxide gas, would act in the same way. Sparrows are usually plentiful and are easily trapped.

Mice.—Mice are slightly less susceptible than sparrows. They may be bred in captivity with little care and are easily handled. On the other hand, they are too small to be easily watched from the deck in case they are lowered to the bottom of the square of the hatch of an ordinary vessel, and quickly die if exposed to wet or cold.

Cats.—Cats have certain advantages in cyanide testing. They feel the effects of the gas about as quickly as rats or mice, and their efforts to escape at this time are both violent and noisy, allowing an opportunity to remove the animal before fatal results occur. A disadvantage is that a cat, unless kept caged constantly, may effectively resist capture, especially after being used once.

Rats.—It was at first thought that there would be a difference in susceptibility between wild and tame rats and between adult and young rats, but as will be seen the difference is not constant and may be disregarded. Rats, while slightly less susceptible to hydrocyanic acid gas than mice, are probably the best animals for routine use when everything is considered. Wild rats become easily terrified and may injure themselves. Tame rats do not have this fault, may be easily reared in captivity, and may be handled without difficulty. They should be protected from extremes of heat and cold at all times, as otherwise they may die unexpectedly.

Directions for raising rats and mice are given at the end of this article.

Conclusions.

Sparrows or other small birds are the most delicate live indicators for hydrocyanic acid gas, but are not recommended for routine work.

Mice or tame rats are almost as susceptible as sparrows and are probably the best test animals available.

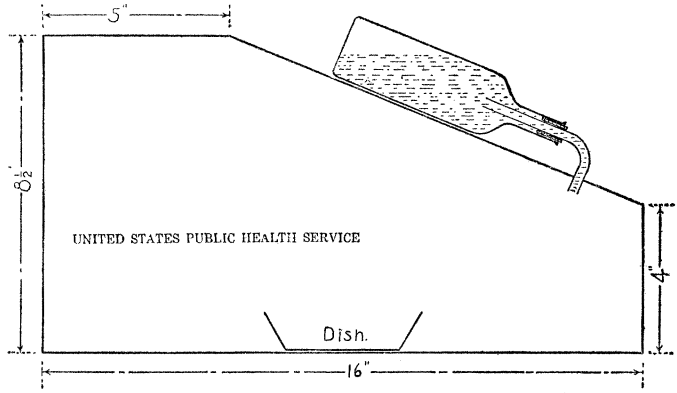
Cats are sufficiently susceptible and with care the same animal may be used several times.

Guinea pigs are quite resistant to the effects of the gas and should never be used where rats are available.

If guinea pigs be the only test animals obtainable, exposure should be prolonged and other allowances made for these animals' increased resistance to the gas, as indicated in the included table.

DIRECTIONS FOR RAISING RATS AND MICE.[1]

Breeding cages.—Rats: Cages measure (see diagram), 16 inches long, 8½ inches high at back, 4 inches high in front, and have a door 5 inches square on top. Each cage sets in a galvanized-iron tray 15 by 17 by 3½ inches. The racks on which these cages are placed are most conveniently made to hold five tiers of cages. The measurements of these racks are 78 inches high, 64 inches wide, 31 inches deep. This provides for two rows of cages, one facing on either side of the rack. The racks are made skeleton fashion of strips of creosoted wood about 1¾ by 1¾ inches for uprights; 4¾ by ¾ inch for cross strips. The cages themselves are made of wire screening of one-half inch mesh. The food is placed in clean porcelain dishes, one to a cage. Water is provided through a bottle with a glass tube inserted through a rubber cork (see diagram). Each tray is filled to the depth of a half inch under the cage with clean sawdust, which is changed once a week. The food consists of a daily feeding of four parts corn to one part sun-



Section of rat cage. Door is on inclined top.

flower seed, a mash of bread and milk smeared on the meshes of the cage once a day, and large squares of dog biscuit wired to the back of the cage.

Mice: The methods for mice differ mainly in using smaller sized cages, viz, 9 by 9 by 7 inches, and more cages to the rack. The mouse racks are made of the same material as the rat racks except that the cages rest on solid boards.

The racks are 60 inches high, 72 inches long, and 14 inches deep. This accommodates 10 cages to the shelf, 1 row deep and 4 tiers to the rack. These cages are not set on trays as the rat cages are, but rest on clean sawdust distributed along each shelf. Mesh for mouse cages should be one-quarter inch to prevent young from falling or crawling through. The same food is used as for rats.

Breeds best suited for raising.—Rats: The hardiest rats are those derived from the Norway breed *Mus norvegicus*, which is the common gray rat in our cities. When caught wild they so preserve their wild temperament that they are rather difficult to propagate, but tamed varieties of these which show a high fertility can be procured from laboratories or fanciers.

Mice: The best breeds of mice may all be classified under the common house mouse, since domesticated varieties have come from the common house mouse *Mus musculus*.

[1] Written for this report by Prof. W. E. Castle and Mr. L. C. Dunn, Bussey Institution for Research in Applied Biology, Harvard University.

The albino, black, and gray varieties are the best breeders. The yellow varieties are especially to be avoided, since the size of the litter and length of breeding period are both less favorable to procuring large numbers. These yellow mice also have a tendency toward an early accumulation of fat which hinders their breeding.

Number of litters that may be expected per year.—From each pair of rats about 6 to 10 litters may be expected during life. They are mature at three months and reach the climax of their breeding ability at about one year. Ordinarily they will not breed after a year and a half old. For the mice this number is slightly larger and the breeding time about the same.

Number in each litter.—Rat litters average about 8. The period of gestation in rats is about 30 days, for mice exactly 21 days. Mouse litters average 6.

Destruction of young by older animals.—Both rats and mice, especially those recently caught, show a tendency to eat their first litter. This possibility decreases with the length of time in captivity and with the age of the animal. The eating is usually done by other females in the cage, so that the best method of prevention is:

1. Isolate the pregnant mothers from breeding cages.
2. Limit the number of mothers bred in any one cage.

Breeding age.—Rats breed at about three months and mice at about one to two months.

Number and sex to each cage.—For both rats and mice the best number has been found to be three females and one male to each cage.

Effects of temperature on breeding.—Both rats and mice breed best at the temperatures ordinarily maintained for human living purposes, say between 65° F. and 70° F. The temperature should be constant and variations above or below normal, although producing no specific effects, reduce the number of young that may be expected and the general vigor of the animals.

Miscellaneous information.—Cleanliness and clean food are important. Shredded tissue paper should be supplied to each cage for nesting. Both rats and mice are subject to the attack of an itch mite, which produces sores, especially on tails and ears. The prevention for this is the elimination of all suspected animals, and the cure is repeated dipping in lukewarm solution of creolin and water, 1 to 100. Cages may be sterilized by dipping in a boiling solution made up in the same way.